



FRASER RIVER
Action Plan
1992 - 93
PROGRESS
REPORT



CANADA'S GREEN PLAN
LE PLAN VERT DU CANADA

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FRASER RIVER ACTION PLAN PROGRESS REPORT 1992 - 93

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EXECUTIVE SUMMARY



In 1992-93, the Fraser River Action Plan (FRAP) put into motion many of the plans, investigations and partnerships initiated in its 1991-92 start-up year. The federal government and its partners made significant progress in the field and continued to gather vital information to ensure long-term sustainability in the Fraser River basin and improve fish and wildlife stocks and their habitat.

Partnerships were strengthened during the year with the signing—by all levels of government—of the Agreement Respecting the Fraser Basin Management Program to coordinate and harmonize initiatives in the basin. A 19-member, multi-party management board began its work with FRAP support. FRAP also contributed to the activities of the Fraser River Estuary Management Program and the Burrard Inlet Environmental Action Program in their cooperative approaches to protecting and enhancing environmental quality. Partnerships with aboriginal peoples were reinforced through their participation in research projects, fish hatchery work, fish stock assessments, and fisheries and habitat monitoring.

Toward its goal of cleaning up pollution in the basin, the Fraser River Action Plan examined discharges from sewage treatment plants and combined sewer overflows to help identify priorities for abatement. Guidelines for the management of wastes in the cement industry were updated. Water and sediment were sampled near six pulp mills to follow changes in contaminant levels and to assess the effectiveness of process changes at the mills. Forty contaminated land sites in the basin received assessment or initial

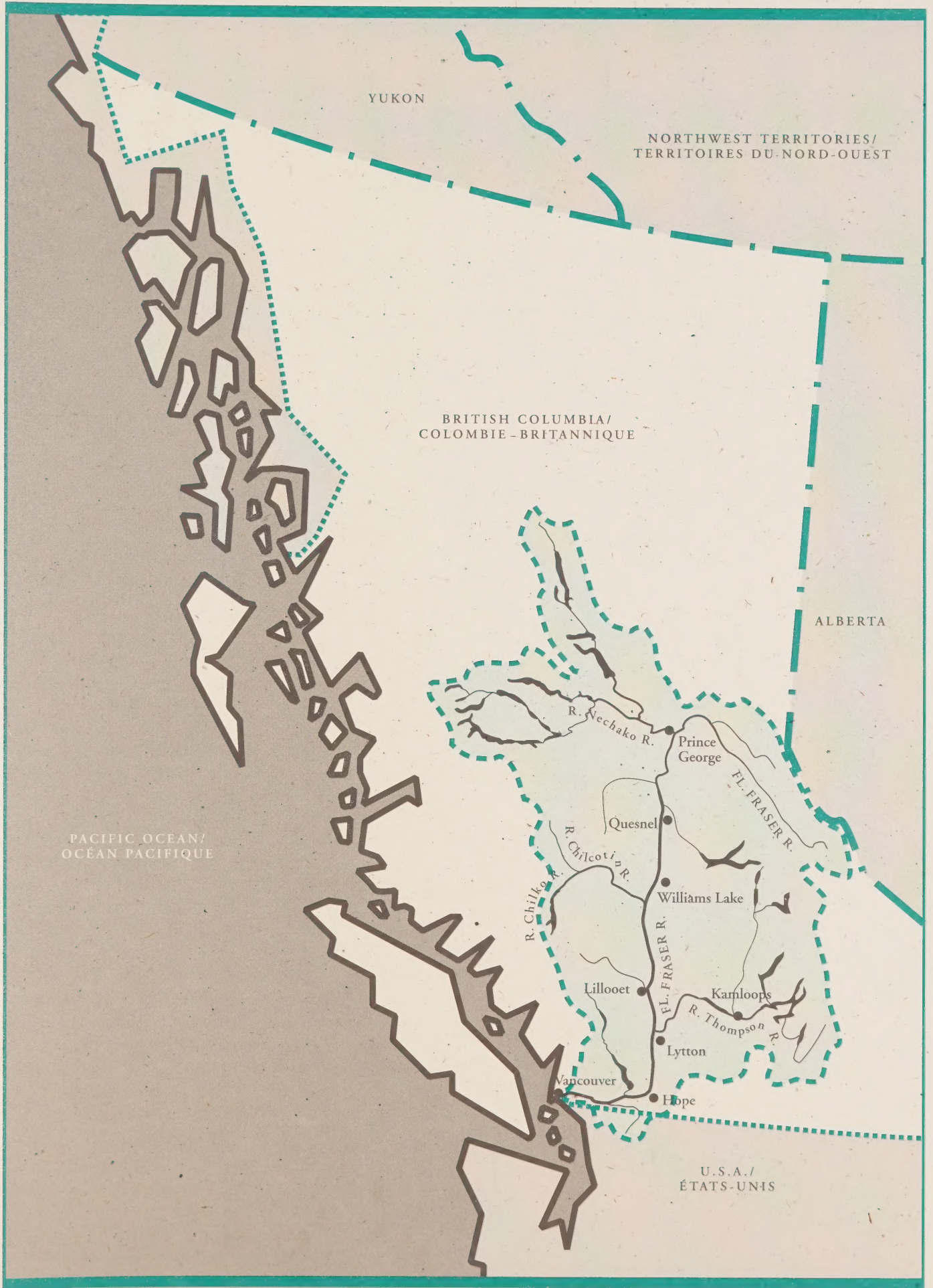
clean-up based on the “polluter pays” principle. FRAP also helped the agriculture industry reduce the release of contaminants into the environment.

To restore the basin’s productivity, several projects were active in protecting and improving fish and wildlife habitat. FRAP worked to enhance fish survival and rebuild salmon stocks to historic levels by restoring degraded habitat, improving spawning and rearing conditions and preventing habitat loss in Kamloops-area streams as well as in the Bonaparte, Deadman and Chilliwack rivers. Science projects contributed important data that can be applied to protecting and enhancing the fisheries resource, such as how dams can avoid “stranding” fish, how logging affects salmon stocks and habitat, and how to prevent death from energy depletion among migrating salmon.

Through FRAP, 1,091 hectares of cover crops were planted on farmland in Delta and Surrey to provide winter staging and feeding habitat for waterfowl, completing the second year of this project. At Salmon Arm, 100 ha of habitat were protected by constructing fences to control grazing and by adding water impoundments and nesting structures.

Investigations continued to provide information to guide sustainable development and integrated resource management of fish habitat, using a computerized mapping system to collect and analyze large amounts of complex data.

Work in 1993-94 will continue to build on the achievements of the first two years in working towards a healthy and productive Fraser River.



YUKON

NORTHWEST TERRITORIES/
TERRITOIRES DU-NORD-OUEST

BRITISH COLUMBIA/
COLOMBIE-BRITANNIQUE

ALBERTA

PACIFIC OCEAN/
Océan Pacifique

R. Nechako R.

Prince George

Quesnel

R. Chilcotin R.

Williams Lake

EL. FRASER R.

Lillooet

Kamloops

R. Thompson R.

Lytton

Vancouver

Hope

U.S.A./
ÉTATS-UNIS





MEETING THE CHALLENGE



The Fraser River Action Plan (FRAP) is a federal government Green Plan initiative to clean up and protect a river system that is vital to the social and economic life of British Columbia, as well as a home to the largest salmon run in the world and an abundance of wildlife. Besides repairing environmental damage, FRAP aims to establish a management program that will promote sustainable development to keep the Fraser basin's ecosystems healthy and productive for current and future generations of British Columbians.

It's an ambitious plan. And since it was announced on June 1, 1991—by federal Environment Minister Jean Charest and Fisheries and Oceans Minister John C. Crosbie—FRAP has made significant strides toward a revitalized Fraser River.

The need for action is pressing. Besides its importance to fish and wildlife, the Fraser River basin is a centre of human activity in the province. Almost two million people, 63% of B.C.'s population, live, work and play here, many in the urban centres of Vancouver, Prince George and Kamloops. The basin supports 48% of the province's commercial forest area, 70% of the metal mine production and more than 44% of the farmland.

All of this human activity has placed competing demands on the river and its ecosystems, causing signs of stress. Overfishing and habitat destruction have severely reduced Pacific salmon stocks, although rebuilding efforts begun in the

mid-1980s have started to reverse the decline. Toxic materials from industrial activities have accumulated in fish and sediments. Many wetlands important to fish and waterfowl have been destroyed or polluted. Meanwhile, a burgeoning population and increasing urbanization and resource development mean the stresses continue to mount.

That's why the federal government, working in partnership with other stakeholders, is taking action with this six-year plan. This report will show the progress of the Fraser River Action Plan in year two toward these three main objectives:

- **Build partnerships**
with provincial and local governments, aboriginal and community groups, environmental organizations, industry and labour, and other stakeholders to develop a cooperative management program for the Fraser basin based on the principles of sustainability.
- **Clean up pollution**
to arrest and reverse environmental contamination and degradation of the Fraser River ecosystems and significantly reduce the discharge of persistent toxic substances into the river by the year 2000.
- **Renew the productivity of the natural environment**
by restoring and enhancing the quality and natural productive capacity of the Fraser River ecosystems and returning its salmon populations to historic levels of abundance.



BUILDING PARTNERSHIPS



The federal government alone cannot clean up the Fraser River and keep it healthy. This will take the concerted and cooperative efforts of all stakeholders in the basin. In a key partnership, the federal departments of Environment (DOE) and Fisheries and Oceans (DFO) are working together in the Fraser River Action Plan, each funding half of the program over the six years. Each department is focusing on its own areas of responsibility, but working toward common goals.

Fraser Basin Management Program

On May 26, 1992, the federal, provincial and local governments signed a five-year jointly funded Agreement Respecting the Fraser Basin Management Program to coordinate and harmonize government and private-sector initiatives to ensure sustainability in the basin. The program will embrace the activities of the federal and provincial governments, 60 local municipal and regional district governments, 96 native Indian bands, and environmental, industry, labour and business interests—all of whom have a role to play in the restoration of the basin.

A 19-person multi-party management board representing these interests was established in August. The board will guide the development and implementation of the management program.

In its start-up year, the board drafted a five-year 1993-98 strategic plan for the Fraser Basin Management Program. In fulfilling its mandate of listening to local communities, the board held a

series of open houses throughout the basin in March 1993 to introduce its members and the program and to identify regional concerns and priorities for action. As well, six working groups have been established to review priorities and coordination in high-priority areas: water resources management, waste management, fish stocks and fish habitat management, information systems, community economic development and communications.

Burrard Inlet Environmental Action Program

The \$2-million, five-year program was initiated by an agreement signed June 21, 1991, by DOE, DFO, the B.C. Ministry of Environment, Lands and Parks, the Greater Vancouver Sewerage and Drainage District and the Vancouver Port Corporation. The Burrard Inlet Environmental Action Program (BIEAP) provides a management framework to coordinate activities intended to protect and improve environmental quality. It aims to reduce existing contaminant discharges to Burrard Inlet, limit the potential for future contamination, control habitat degradation and provide, where appropriate, remedial measures for existing impacts.

Public communication was an important feature of BIEAP in 1992-93 with six public/stakeholder information sessions being held. The status of BIEAP was discussed and input and cooperation was sought on proposed programs and projects. Concerns and priorities identified will be considered when finalizing BIEAP actions.



The Burrard Environmental Review Committee (BERC), a "one-window" review process for all new projects on Burrard Inlet, reviewed more than 76 projects in 1992-93. Actions that may impact the ecology of the inlet come under the review process, such as submarine cable installation, pier reconstruction, dredging projects and sandbar levelling.

Environmental concerns with bulk-loading facilities in the harbour were addressed by producing Best Management Practices guidelines. This focuses on a number of issues from limiting loss of product during loading and unloading to improving storage and controlling stormwater, all aimed at reducing the release of contaminants into the environment.

Other 1992-93 field assessments examined the use of the inlet by waterfowl to provide information on sensitive wildlife habitats, the management of dredged material to provide options for its handling that will form the basis of a dredged material management plan for Burrard Inlet, and fecal contamination levels of shellfish at Maplewood Flats. Also carried out were habitat mapping and a study of sediment movement in the inlet that defined erosion, deposition and contaminant distribution.

Fraser River Estuary Management Program

The Fraser River Estuary Management Program (FREMP) is a forum for a coordinated, cooperative approach among the agencies and port authorities responsible for managing the environmental and economic resources on the Fraser estuary. On June 1, 1991, coincident with the announcement of FRAP, FREMP was extended another three years, with an expanded group of funding partners and a modified mandate.

FREMP's boundaries extend from the mouth of Kanaka Creek to the western edge of the tidal flats, including Boundary Bay. It covers the river on the inside of the dikes. On the other hand, FRAP's area of concern includes the entire Fraser River drainage basin, including the area outside

the river's dikes where activities can affect the quality of water draining into the river.

FRAP and FREMP are inter-related, but operate as independent programs. The Fraser River Action Plan funds some of FREMP's activities and shares the costs of others.

In 1992-93, FREMP's Coordinated Project Review process assessed 143 project proposals to determine their environmental impact on the estuary. In addition, the review process itself was evaluated to determine how effectively it was working.

The Water Quality Plan, a three-year monitoring program largely funded by FRAP, was initiated to sample and analyze water at three sites on the lower river every two weeks. The objective is to assess the health of the estuary by determining both the adequacy of water-quality objectives and the adequacy of waste-treatment facilities in order to protect aquatic resources.



Community groups, Boy Scouts and the public participated in estuary clean-up activities like this one in Delta, which was organized with help from FREMP.

FREMP also began drafting an Estuary Management Plan, similar to municipal Official Community Plans, that will guide planning. One component of the plan will be area-designation agreements, like foreshore zoning, with all jurisdictions.



Local estuary clean-up activities, using industry donations, were coordinated with community groups to remove garbage and debris at Brownsville Bar near Pattullo Bridge, along River Road in Delta and near Annacis Island.

Two habitat projects were conducted under FREMP. One mapped the occurrence of purple loosestrife (a plant that might out-compete productive marsh-plant species) and another documented productive habitats that are showing signs of degradation.



Aboriginal people were active in several projects such as this, one on Cayoosh Creek in which pink salmon fry were counted using inclined plane traps.

Participation by First Nations

Aboriginal people play a major role in the Fraser River Action Plan. Not only do they have historical ties to the river and a large stake in its future, they also participate in a variety of FRAP projects through their increased involvement in fisheries management. In 1992-93, FRAP contributed \$2 million to native groups as part of the Aboriginal Fisheries Strategy (AFS), a DFO initiative designed to ensure the government's obligations to aboriginal peoples are met while maintaining stability in other fisheries sectors.

Native projects under FRAP included cleaning up streams, building side-channels, recreating lost estuarine marsh, building fish ladders, conducting

habitat inventories and counting spawning salmon.

A number of agreements were forged in 1992-93 with the Lower Fraser Fishing Authority, comprising the Sto:lo Tribal Council, Musqueam and Tsawwassen bands. Band members carried out fish stock assessment and evaluated the impact on fish habitat from development projects on native land. The bands are also developing a long-term plan to boost their efforts in habitat monitoring and pollution-watch areas. The presence of aboriginal guardians, being trained as part of the AFS, provided another mechanism for reporting habitat destruction and pollution on the lower river.

Aboriginal groups also cooperated in research projects. One such project was carried out by DFO scientists from the Pacific Biological Station to examine the capacity of habitat to produce pink salmon and the interaction between habitat and salmon stocks. Native groups, such as the Shuswap Nation Tribal Council and Cayoose and Soowahlie bands, counted pink fry from the Thompson River, Cayoosh Creek, Chilliwack/Vedder rivers and Upper Fraser River using inclined plane traps. The data were used to estimate fry numbers emigrating

from the spawning areas and were compared to previously gathered data on habitat.

Members of the Tl'azt'en Tribal Nation are part of a research team investigating the long-term effects of logging on salmon production in the Takla Lake area in north central B.C. The results will help draft fisheries/forestry guidelines for the interior of the province.

The Upper Stl'atl'imx Nation, a group of six bands around Lillooet, worked in a hatchery with local DFO staff, clipping fins, catching salmon for egg stocks, preparing eggs and distributing eggs to schools and participated in community education programs. During the year, members worked



with B.C. Hydro fisheries staff to improve the habitat on the Bridge River near the Terzaghi Dam, such as installing spawning platforms. Work also included inspecting sites where there are potential fisheries problems and keeping track of spawning sockeye.

The North Thompson Band received funds to operate the Clearwater Hatchery chinook salmon program that is being used to train native people as fish culturists. At the Stuart River, the Nak'azdli Nation worked with DFO staff from the West Vancouver lab to count chinook using new technology called a rotating drum trap.

Communications

Public participation is integral to the Fraser River Action Plan. So is cooperation among the many interests in the basin. In this regard, it is

important to foster communication among governments, First Nations, industries, interest groups and the public that allows for the forming of crucial partnerships, keeps the basin's population aware of the issues and activities affecting the river and provides an avenue for public input.

Communications activities in 1992-93 included displaying a computerized video presentation, which summarizes issues on the Fraser River including the FRAP program, at trade shows and environmental expositions. This second progress report, intended to keep stakeholders abreast of FRAP, follows one released in June 1992. FRAP also supported the publication of "Discover Your Estuary," a book that focuses on the aquatic environment of the Fraser estuary and looks at estuary history, culture and ecology.



CLEANING UP POLLUTION



The environmental condition of the Fraser River is at a crucial stage. By taking action before it is too late, the federal government, working in partnership with other stakeholders, can repair the damage and ensure the river is protected for future generations. Cleaning up pollution is the Fraser River Action Plan's second main objective and includes pollution abatement, water/ environmental quality and compliance/enforcement.

Pollution Abatement

Cleaning up the Fraser River basin depends on pollution abatement. The overall goals of the program, to be achieved in partnership with the province, are to reduce by 30% the discharge of environmentally disruptive pollutants entering the basin by 1997, and to significantly reduce the release of persistent toxic substances into the basin's waters by the year 2000. Toxic substances are defined by the Canadian Environmental Protection Act.

The strategy for pollution abatement includes: inventories of sources, discharge characterizations and estimates of amounts, reviews of process and treatment systems, best available technologies, environmental impacts and economic instruments. A close link is forged with the compliance/enforcement process as an abatement tool.

Pollution abatement focuses on industrial and municipal discharges, urban and agricultural runoff, groundwater contamination, contaminated waste sites and airborne contaminants. There

was significant progress in each of these areas in 1992-93.

Regarding industrial discharges, an inventory of point sources was completed and a database developed to include information on permitted discharge limits, applicable federal regulations and maximum pollutant loadings to the environment. Methods were developed for chemical characterization and toxicity testing to be applied consistently in the basin, allowing comparison of the toxic potential of a range of waste-water discharges.

In partnership with FREMP, 11 discharges were characterized in the lower Fraser River. Water and sediment in the immediate discharge area were also sampled to assess environmental impact. This information will help set priorities for sites or industrial sectors needing abatement action in the coming years. Attention also focused on the cement industry with an update to its guidelines for the management of wastes.

Another project completed in 1992-93 was a survey of 25 closed and abandoned metal mines in the Fraser River basin to determine the environmental impact of acid rock drainage (ARD) on river and lake water. Using data on the mines and their drainage quality, the mines were ranked according to their potential to generate ARD. Six of the mines were visited and samples taken from rocks, tailings and water. The survey concluded the potential for ARD in the basin is lower than elsewhere in B.C.



A study of the effects of historic gold-mining activity at Wells, B.C., revealed that mine tailings deposited in Jack of Clubs Lake are not toxic to laboratory organisms. Further work is underway to determine the implication of these results to the lake ecosystem.

An inventory of municipal discharges (from sewage treatment plants and combined sewer overflows) was completed in the year and methods for sampling and characterizing discharges were developed. Characterization work was carried out with the Greater Vancouver Regional District to begin establishing priorities for abatement. Effluent and sludge characterization was co-funded with the city of Prince George to improve its sewer bylaws and reduce the discharge of toxic substances. An inventory of sewer-use control programs was also conducted to help municipalities develop more stringent source controls.

Urban runoff was addressed by work to measure contaminants and help define priority areas. A project co-funded with the GVRD and Surrey focused on the use of wet ponds for the treatment of runoff.

Reducing contaminants from the agriculture industry was another priority in 1992-93. Funds were provided to the B.C. Federation of Agriculture to accelerate the development of guidelines for the greenhouse and nursery industries aimed at reducing the use and release of manure and agrochemicals. The federation also received funds to augment its training program for inspectors to teach poultry, beef and dairy farmers about environmentally friendly practices, such as applying fertilizers and storing manure in such a way as to prevent contamination of creeks and groundwater. As well, a project was co-funded with the B.C. Federation of Agriculture to develop a pest-management plan that will replace toxic pesticides with environmentally friendly alternatives.

DOE, operating under FRAP and the National Contaminated Sites Remediation Program, was active in assessing or initiating clean-up of 40 contaminated land sites in the basin based on the "polluter pays" principle. Sites included wood

preservation facilities, hydro utilities, railways; petro-chemical plants and airports. A partnership was formed with the B.C. Ministry of Environment, Lands and Parks to set up a computerized inventory of contaminated sites that will help plan future remediation.

Groundwater receives contaminants from a variety of industrial, domestic and agricultural sources. An inventory of all unconfined aquifers in the Fraser basin was completed in 1991-92 in conjunction with the Geological Survey of Canada. This inventory was used in 1992-93 to compare the location of sensitive groundwater reserves with contaminant locations determined from the industrial, municipal, agricultural and contaminated sites programs. A review was also done on the impact of septic tank effluents/leakages into groundwater to determine the magnitude of the problem and provide possible approaches.



Sediment was collected as part of a pollution abatement project to examine the use of wet ponds in Surrey for treating urban runoff.

The atmosphere can be another significant source of toxic contaminants. A data base for information on the basin was designed and in 1993-94 an inventory will begin to identify major sources, on an industry by industry basis, of contaminants entering the basin and sites that may need abatement action.



Effluent in combined sewer overflows was sampled in cooperation with the Greater Vancouver Regional District.

Water/Environmental Quality

The aims of the environmental quality component are to determine what is known about the condition of the Fraser River, particularly the aquatic environment; to identify gaps in information; and to fill in these gaps in cooperation with other partners. It also aims to establish environmental quality objectives, against which clean-up activities can be evaluated; to measure the effectiveness of clean-up actions; and to provide information that will help anticipate and avoid future pollution problems.

Environmental quality research focuses on investigating the impact of contaminants on plants and animals and developing knowledge of Fraser River ecosystems. Five such projects began in 1992-93. They include studies of Dungeness crab from the Fraser estuary and invertebrates from the river near Agassiz as indicators of contaminant stress, population changes of invertebrates in the Thompson River from 1973-1992, and the feasibility of using various fish species as indicators of the impact of pulp mill effluents.

In environmental assessment, five years of data from nine stations that monitor water quality in the Fraser basin were compiled and analyzed for

trends or changes. In another project, water and suspended sediments were sampled upstream and downstream of six pulp mills in the basin to follow changes in contaminants, such as dioxins and furans, to assess the effectiveness of process changes at the mills. Samples were taken under varying river conditions, including low flow under ice when pulp mill effluents are expected to have the most impact on the environment. Results will be published in 1994 and will be available from the Environmental Conservation Directorate of DOE.

The assessment group began designing a basin-wide sampling program to determine and track the condition of the river environment, including living organisms, over time. Other agencies working in the basin participated in the process.

Sampling will begin by the end of summer 1993 and continue over the next four years.

Under the environmental objectives project, government agencies are working together to develop "ecosystem objectives." Ecosystem objectives relate to the environment as a whole and include not only chemical-specific water-quality objectives, but also the impacts of human activities. They establish measurable indicators of the health of the basin that can be monitored over time to ensure that clean-up programs are effective in restoring the health of the river.

Scientists from several Canadian and American agencies participated in a workshop to compare experiences of using ecosystem objectives and to apply them to the Fraser basin. As a result of the workshop, a pilot study will implement ecosystem objectives in a Fraser basin watershed. The results of this project should provide a framework for deriving and applying ecosystem objectives in this region.

A bibliography was compiled of more than 4,000 references to scientific information about the basin's environmental quality. It will serve as an information base useful to all components of FRAP. Data on organic contaminants in soil, sediment, water and organisms from the Fraser



basin were summarized and rated to make a valuable index and reference tool.

A 1992-93 DFO science project contributed to the water quality program by measuring contaminants in fish tissues. Juvenile chinook salmon were collected in the Fraser River and their body tissues measured for organochlorine contaminants. Results showed fish collected from the upper and lower river had lower levels than those sampled in the late 1980s from the same locations. The reduced contaminant levels appear to result from regulations prohibiting the use of organochlorine wood preservatives in sawmills and from reduced use of chlorine by bleached kraft pulp mills.

Another fisheries project will aid pollution monitoring in the Fraser estuary and was part of the FREMP Water Quality Plan. Starry flounder were tagged with ultrasound or radio tags to determine their distribution and movements, while others were collected to provide tissue for analyses of metal and organic contaminants. Preliminary results indicate that starry flounder can be useful as a "sentinel" species to help scientists monitor pollution and fish health in the lower river.

Compliance/Enforcement

Enforcement is central to achieving the pollution reduction/abatement strategies of FRAP. Enforcement activities include both inspections to evaluate compliance with established laws and investigations of more serious violations where deterrent actions, including laying charges, may be taken.

Both DFO and DOE carry out enforcement under the Fisheries Act and regulations, and the Canadian Environmental Protection Act (CEPA) and regulations. Broadly speaking, DFO looks after physical alteration of habitat under the Fisheries Act, while DOE is responsible for dealing with water quality under the Fisheries Act and the control of toxic chemicals under CEPA.

DOE conducted 303 inspections in the Fraser basin in 1992-93. Facilities inspected included those with effluent discharges such as municipal

treatment plants, pulp and paper mills, metal mines and wood preservation and treatment facilities. In addition, dredging activities (materials destined for ocean dumping) and facilities regulated under CEPA (e.g. PCB waste-storage sites and vendors of fuel and ozone-depleting substances) were inspected. Based on the inspection program, an average of 82% compliance with regulatory requirements was achieved in all sectors.

When significant violations are found during an inspection, or as a result of a spill or anonymous tip, an investigation is launched. Thirty investigations were initiated in the basin, resulting in numerous warnings and prosecutions. Fines against polluters have totalled \$87,000.

DFO began an inter-agency Environmental Watch program to receive habitat complaints using the existing radio and dispatch system, which has a violation-reporting line, and by training additional radio operators. DOE contributes to, and uses, these radio facilities for enforcement operations.

FRAP's inspection and investigation programs will continue in 1993-94. In order to improve enforcement capability, a DOE field office will open in Prince George in the summer of 1993. This will decentralize enforcement activities and help to meet the goal of the enforcement program—90% compliance with federal and provincial environmental legislation by the end of FRAP.



The Fraser River estuary is a prime habitat area, where the demands of urbanization and industrial development have been acutely felt.



RESTORING THE PRODUCTIVITY OF THE NATURAL ENVIRONMENT



The Fraser River basin is a major salmon producer on a world scale and is vital to wildlife. Its estuary hosts the largest population of wintering waterfowl in Canada and provides a key feeding and resting stop for thousands of migratory birds.

Restoring the productivity of the basin's natural environment is another thrust of the Fraser River Action Plan. Steps include rebuilding salmon stocks to previous levels of abundance; improving scientific knowledge; and restoring and enhancing fish and wildlife habitats.

Salmon Habitat Rehabilitation

The Salmonid Enhancement Program's (SEP) role under FRAP is to restore and enhance fish habitat to ensure the survival of existing stocks and rebuild salmon stocks to historic levels of abundance. This role includes improving degraded habitat, providing fish access to blocked-off or inaccessible habitat, providing water storage for systems with periodic low flows, stabilizing river and stream banks to prevent habitat loss and improving spawning and rearing conditions.

The need for action is demonstrated by annual sockeye salmon runs. Averaging more than 34 million at the turn of the century, that figure plunged to an average of less than eight million in the 1975-86 period mainly as a result of over-fishing. Stock rebuilding efforts initiated in the

mid-1980s boosted sockeye runs so that between 1989 and 1992 the number returning to the Fraser climbed to an average of almost 15 million a year. But there is still a long way to go to equal turn-of-the-century levels.

In 1992-93, SEP was involved in four FRAP projects. Work on the Chilliwack River, a favourite of steelhead and coho salmon sports fishers, aims to divert the river away from exposed clay banks and thus reduce the high level of suspended solids in the water. During the year, dikes were reinforced and a side-channel was excavated for spawning and rearing in the Ranger Run area.

This built on previous efforts by DFO and the B.C. Ministry of Environment, Lands and Parks (MELP) to repair damage to the river bank caused by floods and landslides, which deposited hundred of thousands of cubic metres of clay and silt onto spawning grounds. The FRAP work is expected to boost production of all fish species. Work in 1993-94 will target shifting the river away from a large slide at Willow Run.

In the Kamloops area, streams have been subjected to habitat damage by grazing cattle, which trample the banks and destroy bank-stabilizing vegetation. This results in channel shifting, the silting of spawning beds as well as less food production, shade and escape cover for rearing salmon. FRAP funding has allowed fences to be built along streams to keep out cattle and



banks to be planted with willow and red osier dogwood cuttings for stabilization.

On the Bonaparte River, a small dam was completed to store water to augment periods of low water flow. Work in 1992-93 was the second phase of construction under a joint DFO/MELP agreement to provide more flow to the 100-km of river opened up to salmon by the Bonaparte fishway. The year saw 300 adult steelhead trout and 2,300 chinook salmon successfully pass through the fishway into previously inaccessible habitat. The dam will control water flow and enhance fish survival by preventing freezing and drying of spawning beds in the winter and by providing better conditions for rearing and migrating.

Work was also undertaken on a side-channel of the Deadman River near Kamloops, completing a project begun in 1991-92. The work involved developing techniques to improve rearing habitat, stabilize banks and install fencing to keep cattle out of the channel. Targeted fish species were coho, chinook and steelhead.

Techniques in this project included constructing side-stream alcoves with root wads and tumbleweeds as cover to protect rearing fish, and installing stream-bed refuge pits and floating log structures to provide hiding areas for juvenile salmon. Stream banks subject to annual erosion were strengthened and protected using coniferous trees placed in the stream and tied to anchors on the shore. This technique also provides in-stream cover for rearing salmon.

Plans for 1993-94 include habitat restoration in partnership with B.C. Hydro to recover lost fish productivity on rivers such as the Bridge and Shuswap, which have dams, and work to rehabilitate estuarine habitat in cooperation with the Fraser River harbour commissions.

Improved Science Base

Six DFO science projects were active in 1992-93 with FRAP funding, contributing vital data that can be applied to protecting and enhancing the fisheries resource. A project that made good headway is measuring the energy expended

by adult salmon during spawning migration in the Fraser River to determine how water flow, water temperature and contaminant level affect this process. These data are critical because protecting salmon requires that they be able to reach their home streams and spawn successfully. Since salmon stop feeding once they enter fresh water, they must have enough energy stored in body tissues when they enter the river in order to complete their life cycle. Energy depletion is a major cause of pre-spawning deaths.

Researchers implanted radio transmitters (EMG tags) into adult Fraser sockeye. Work in 1992-93 at DFO's Cultus Lake research lab indicated that EMG signals recording muscle activity can be used to measure energy expenditure. Field tests will begin in 1993-94 in which Early Stuart sockeye will be tagged and monitored as they swim through varying water conditions on their entire river migration to identify locations of high energy use. This knowledge is needed to find out where corrective measures could make the journey easier for migrating salmon, thereby reducing mortality.

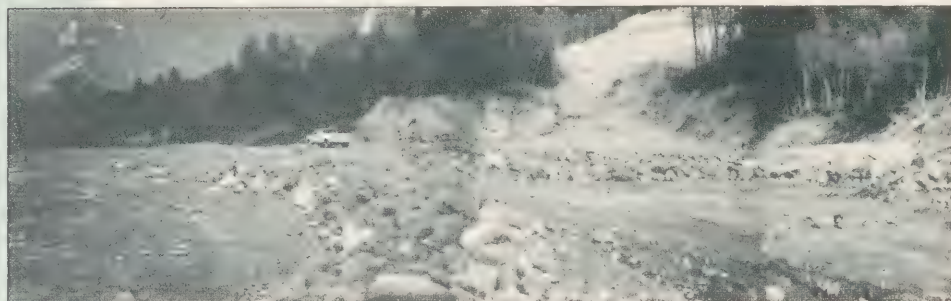


Salmon eggs were gathered in sampling nets for a project to determine the long-term effects of logging on sockeye salmon stocks and habitat in the Stuart/Takla area.

FRAP enabled researchers to gather data on the long-term effects of logging on sockeye salmon stocks and habitat in the Stuart/Takla area in north central B.C. The results will be used to



develop interior fishery/forestry guidelines. A research team has combed four tributaries of Takla Lake, studying stream bed composition, salmon egg distribution, oxygen content, insect populations, stream and air temperature and sediment content.



Habitat enhancement at the Ranger Run area of the Chilliwack River included diverting the water away from exposed clay banks (centre top) to a new course on the left of the picture.

Conditions will be documented before and after logging. Scientists want to find out how logging affects stream temperatures and sedimentation and, in turn, how this affects sockeye egg survival. Partners in this effort include DFO, the B.C. Ministry of Forests, B.C. universities, forest companies and the Tl'Az't'En Tribal Nation.

A study of factors affecting production of Upper Fraser chinook salmon focused on the impact of sudden decreases in water flow below dams. Juvenile salmon dying because of sudden decreases in flow during the winter is a serious problem. But an examination of salmon behaviour found that by making flow changes at night, and ensuring that the changes are gradual, mortality due to "stranding" could be largely avoidable. Data from this and further work in the project will help habitat biologists make informed decisions about development proposals and assist in formulating guidelines for dam operation.

Work in the Fraser River estuary made strides in evaluating the success of restored wetland habitat in an area where 70% of marshes have been destroyed. Examining 11 replanted sites, researchers found that the location of restored

habitat in the intertidal zone, which determines how long it is underwater, affects its productivity for fish. This information will be vital in planning future successful restoration projects.

FRAP also funded research to identify the relationship between the quality and quantity of Fraser River discharge and the number of coho and chinook salmon that can be supported by the Strait of Georgia, and to collect data on the productive capacity of the Fraser and Thompson rivers by assessing the correlation between habitat and pink salmon production. (For more details on this project, see *Participation by First Nations*.)

Fish Habitat Management Planning/Restoration

Fifteen fish habitat management areas have been identified in the Fraser River basin, based on geographic and salmon stock characteristics. A major component of DFO's habitat restoration under the Fraser River Action Plan is the development of habitat management plans (HMPs) for each area. They will outline the status of fish resources and habitat, the sensitivity and productive potential of each watershed. The plans will be used to guide sustainable development decisions by providing essential information for integrated resource management.

The first HMP was completed in 1992-93 for the Stuart/Takla area and a draft plan was circulated to native bands, government agencies and individuals for review. The North Thompson habitat plan also has reached a review stage and a draft will be circulated in mid-1993. Public consultation on these plans will determine a model for the remaining 13 areas in the basin.



Planning for the Fraser/Delta habitat area also began last year. Studies were completed on the flow and water use of salmon streams there and in six other management areas. The year also saw the development of a simplified method of evaluating stream sensitivities and the completion of an initial report.

To help the habitat planning team create management plans for all Fraser sub-basins, GIS (Geographic Information System) technology was introduced and implemented in 1992-93. This system provides computerized maps of the basin, making it possible to collect, synthesize and analyze the massive volume of information needed to deal with this large and complex area.

Three contracts were initiated during the year to begin assembling computerized data, including one to produce the first 53 of a needed 300 stream maps, one to map land use in the Quesnel and North Thompson planning areas using satellite photographs, and another to map shoreline and river vegetation using airborne high-resolution imagery. Partners in the contracts include DFO, the B.C. Ministry of Environment, Lands and Parks, the Canada Space Agency and the Canadian Centre for Remote Sensing.

Apart from GIS, mapping was completed for 50-km of shoreline on the Nechako and Fraser rivers at Prince George that identified vegetation and prime habitat areas and their relative sensitivities. The results are intended to be tools in assessing and mitigating the impacts of park and industrial plans on the city's riverfront.

FRAP completed a review in 1992-93 of all habitat compensation areas in the Fraser estuary to evaluate the effectiveness of a DFO policy of "no net loss" in this sensitive habitat area. The policy requires that habitat losses resulting from development projects on the estuary be offset by habitat replacement. The review indicated areas where improvements can be made in procedures and monitoring to ensure that no net loss is attained.

Wildlife Habitat Restoration

DOE's efforts in wildlife habitat restoration focus on estuary and land conservation, interior wetlands conservation and forest ecosystem diversity.

Estuary and land conservation aims to protect and enhance biodiversity in upland ecosystems vital to the staging, feeding and wintering of hundreds of thousands of waterfowl and shorebirds each year. The Greenfields project, which involves planting winter cover crops on farmland in Delta and Surrey, completed its second year in 1992-93. The project aims to enhance soil, provide winter staging and feeding habitat for waterfowl and improve relations between farmers and wildlife managers. In the year, 1,091 hectares were planted, with the project providing the cost of seed and farmers providing the land and labour. An interim report is available from the Greenfields Project and a summary report on the two previous years will be available later in 1993.



Thousands of waterfowl and migrating birds like these snow geese depend on the habitat of the Fraser River estuary.

Other work on estuary lands included an evaluation of sediment and vegetation distribution on the Boundary Bay tidal flats and a review of 400 wetlands in the Fraser lowlands. Information gained in these and other studies will lead to improved management of wetlands and waterfowl. Several reports on lower Fraser wetlands are now available from the Canadian Wildlife Service (CWS).



The objectives of interior wetlands conservation are to improve biodiversity and waterfowl productivity and maintain the water table in the basin's interior wetlands. To this end, a project to protect 100 ha of habitat at Salmon Arm was completed in 1992-93. It included constructing fences to control grazing, removing grazing leases in critical areas, concentrating grazing in less critical areas and adding water impoundments and nesting structures. Partners in the project included Ducks Unlimited, Neskainlith Indian Reserve, Adams Lake Band, Salmon Arm Bay Nature Enhancement Society and the B.C. Ministry of the Environment, Lands and Parks.

Through the forest ecosystem diversity program, DOE will develop, in cooperation with governments, universities and others, forest management practices to benefit wildlife, enhance biodiversity and protect threatened ecosystems.

Under this program, the CWS signed a funding agreement with The Nature Trust of B.C. to computerize existing habitat and nest records of birds in the Fraser basin, which will highlight important forest habitats.

Several other joint funding agreements involve strategies for forest diversity with the B.C. Conservation Foundation and the University of B.C.; Shuswap-area biodiversity with government, private-sector and university involvement; and habitat and breeding requirements of woodpeckers in relation to forest land-use practices in the Kamloops region. This work will lead to improved management of wildlife and wildlife habitat. Several reports, including a pamphlet on "Bald Eagles and Forestry" will soon be available from CWS.



OUTLOOK FOR 1993-94



The Fraser River Action Plan will see an expansion of activities in 1993-94 in both the DOE and DFO components. FRAP's programs and co-operative arrangements have been reviewed and restructured in light of the first two years of experience with the aim of improving performance and facilitating partnerships. Long-term objectives have been reviewed and modified where appropriate to reflect current conditions.

Existing partnerships with other governments and stakeholders will be maintained and strengthened, especially through new field demonstration projects and increased field staff capability. Federal, provincial and local governments will contribute to the Fraser Basin Management Board enabling it to implement a strategic plan for sustainability in the basin.

Fish habitat restoration and management will be expanded, with much of this work being jointly funded with partners. For example, a major restoration project is planned for the Big Bend area of Burnaby, with costs shared by the North Fraser Harbour Commission, the Municipality of Burnaby and FRAP. Other new projects include recovering lost habitat in partnership with B.C. Hydro on the Bridge and Shuswap rivers and rehabilitating estuarine marsh in cooperation with the Fraser River harbour commissions and coordinated by the Fraser River Estuary Management Program.

Science and mapping initiatives will be upgraded to better establish the relationships between habitat conditions, production, fish conservation and enhancement.

The DFO program has been restructured to ensure First Nations are actively participating in FRAP through the Aboriginal Fisheries Strategy. FRAP's investment in native projects will increase by 50% from the previous year. First Nations will use this funding to establish sustainable upriver fisheries management regimes, collect data on fish stocks and habitats and restore habitat.

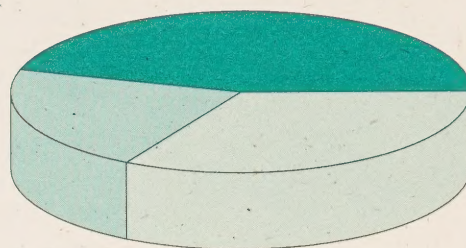
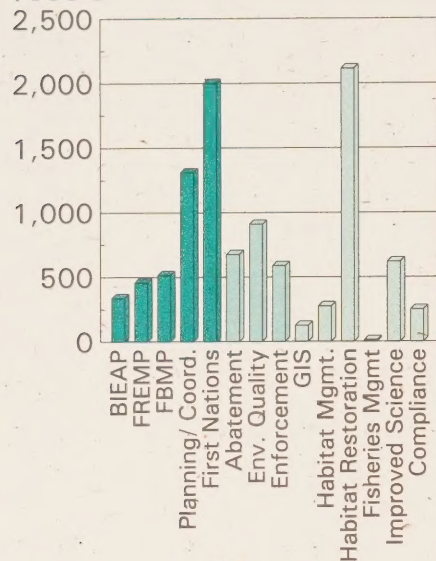
Enforcement capability will be improved with the opening of a field office in Prince George. Pollution abatement will continue identifying contaminant sources and emphasizing clean-up activities.

A third interior wetlands demonstration project will be initiated, adding to those at Monte Creek in Kamloops and Salmon Arm established in the first two years. Again, about 1,200 hectares of estuary farmland will be planted with cover crops to improve winter habitat for waterfowl and continue the successful Greenfields project. DOE will continue to protect estuary land for wildlife to reach a goal of 15 hectares of dedicated land by the end of FRAP.



FINANCIAL REPORT 1992 - 93

\$000's



■ Partnerships
■ Clean Up
■ Restore Productivity

Department of Fisheries and Oceans

\$ X 1000

Expenditures

Building Partnerships

Burrard Inlet Environmental Action Program	80.0
Fraser River Estuary Management Program	98.1
Fraser Basin Management Program	262.0
Communications	146.0
Planning & Implementation	296.0
First Nations Participation	2,000.0

Cleaning Up Pollution

Water Quality	64.0
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Restoring the Productivity of the Natural Environment

Geographic Information Systems	124.0
Habitat Management	274.0
Habitat Restoration	306.0
Fisheries Management	12.0
Improved Science Base	608.0
Enforcement & Compliance	249.0

Total **4,519.1**

Contribution to Government Restraint 537.9

Total Budget **5,057.0**

Environment Canada

\$ X 1000

Expenditures

Building Partnerships

Burrard Inlet Environmental Action Program	255.0
Fraser River Estuary Management Program	358.0
Fraser Basin Management Program	251.0
Integrated Planning	195.7
Program Coordination ¹	672.7

Cleaning Up Pollution

Pollution Abatement	673.4
Environmental Quality	844.5
Enforcement	586.8

Restoring the Productivity of the Natural Environment

Habitat Restoration & Conservation	1,808.6
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Total **5,645.7**

Contribution to Government Restraint² 1,854.3

Total Budget **7,500.0**

¹ Includes Communications

² Includes 69.2 K for Federal Laboratories

If you would like to
find out more about the
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